

The genus *Melanocarpus*

## Exhibit D

J. GUARRO<sup>1</sup>, S. K. ABDULLAH<sup>2</sup>, S. M. AL-BADER<sup>2</sup>, M. J. FIGUERAS<sup>1</sup>, AND J. GENÉ<sup>1</sup><sup>1</sup> Unitat de Microbiologia, Facultat de Medicina, Universitat Rovira i Virgili, 43201 Reus, Spain<sup>2</sup> Biology Department, College of Sciences, University of Basrah, Iraq*Melanocarpus* is redescribed and a key to the four accepted species is given. A new species and combination are proposed.

In the last few years we have had the opportunity to examine sodariaceous fungi from different substrates, received from several countries for identification. Among them we noticed some interesting non-ostiolate ascomycetes probably not described before and with affinities with *Melanocarpus* Arx.

The relationships between *Melanocarpus* and other non-ostiolate Sordariales are not always clear. von Arx *et al.* (1988) recently discussed them. The closest genera are *Thielavia* Zopf, with fusiform or ellipsoidal ascospores; *Boothiella* Lodhi & Mirza, well distinguished by its four-spored asci and translucent ascomata; *Chaetomidium* (Fuckel) Zopf, with ascomata covered by long hairs and ascospores limoniform or broadly fusiform; *Corynascus* Arx and *Corynascella* Arx usually having ascospores with two germ pores. All these genera apparently form a homogenous group and were included by von Arx *et al.* (1988) in the Thielaviaceae on the following characters: ascomata non-ostiolate, usually spherical; asci cylindrical-clavate or obovate, often stalked, with evanescent walls; ascospores unicellular, unsheathed, smooth and with one or two germ pores. According to Eriksson & Hawksworth (1988) this family was published invalidly. Hence these above genera were included in the Chaetomiaceae and Ceratostomataceae (Eriksson & Hawksworth, 1991).

*Melanocarpus* Arx, *Stud. Mycol.* 8: 17 (1975).

Saprotrophic. Thermophilic or mesophilic. Colonies expanding. Ascomata superficial, immersed or erumpent, spherical, non-ostiolate, dark, smooth, covered with short setae or with undifferentiated hyphae, with a thick wall of *textura angularis* or *epidermoidea*. Asci subglobose, obovate or cylindrical-saccate, 8-spored, very evanescent. Ascospores oblate, globose or subglobose, less frequently broadly ovoid or broadly ellipsoidal sometimes with one flattened side, unicellular, dark brown or opaque when mature, with de Bary bubbles, thick- and smooth-walled, with a distinct germ pore; anamorph

*Chrysonilia*-like, forming catenate, hyaline, relatively large fission cells (arthroconidia).

Type species: *Melanocarpus albomyces* (Cooney & R. Emers.) Arx.

## ACCEPTED SPECIES

*Melanocarpus thermophilus* (Abdullah & Al-Bader) Guarro, Abdullah & Al-Bader, comb. nov.

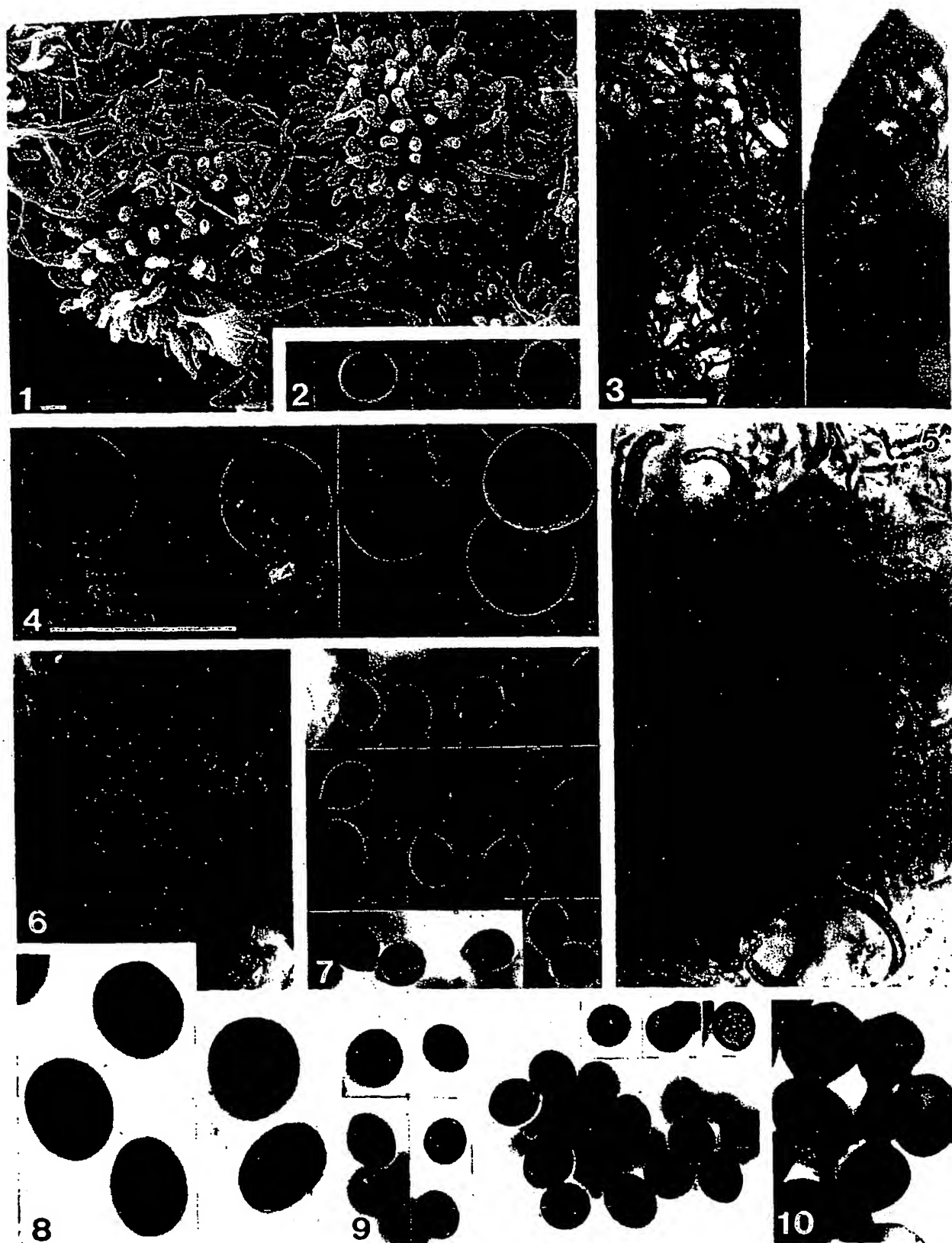
≡ *Thielavia minuta* (Cain) Malloch & Cain var. *thermophila* Abdullah & Al-Bader, *Basrah J. Agric. Sci.* 5: 116 (1992) (Figs 1–4, 11)

Colonies growing slowly. Ascomata 90–160 µm diam., globose, superficial, dark brown to black. Ascoma hairs uniformly distributed, septate. Peridium brown to dark brown 4–6 µm thick, with *textura epidermoidea*. Asci 8-spored, subglobose, 15–20 × 14–16 µm, evanescent. Ascospores unicellular, variable in shape, globose, subglobose to broadly ovoid, sometimes flattened in one side, thick- and smooth-walled, 7.5–9 × 6–7.5 µm, with a distinct and protuberant germ pore, dark brown when mature, with a de Bary bubble. Anamorph not observed.

Material examined: BSR (1006) (holotype), dried culture on PCA, isolated from Nineva forest soil, North Iraq, August 1987. Isotypes: FMR 4687, and also in IMI and CBS.

A more detailed description is reported in Abdullah & Al-Bader (1992).

In a recent paper on Iraqi soil fungi, Abdullah & Al-Bader (1992) described the new fungus *Thielavia minuta* (Cain) Malloch & Cain var. *thermophila* Abdullah & Al-Bader, isolated from forest soil. This fungus was obtained using the soil plate method (Warcup, 1950) after incubation at 45 °C. The isolate was compared with the original description of *Thielavia minuta*, also isolated from forest soil but in Australia and first described by Cain (1961) as *Chaetomidium minutum* (Figs 5–7, 11). Later, Malloch & Cain (1973) transferred this species to *Thielavia*. Because of some differences



Figs 1–10. Fig. 1. Ascomata of *Melanocarpus thermophilus* BSR 1006; Figs 2, 4. Ascospores of *M. thermophilus* BSR 1006; Fig. 3. Peridium of *M. thermophilus* BSR 1006; Fig. 5. Ascoma of *Thielavia minuta* TRTC 36863; Fig. 6. Peridium of *T. minuta* TRTC 36863; Fig. 7. Ascospores of *T. minuta* TRTC 36863; Fig. 8. Ascospores of *M. albomyces* CBS 177.67; Fig. 9. Ascospores of *M. coprophilus* FMR 2601; Fig. 10. Ascospores of *M. oblatius* CBS 775.85. Bars = 10  $\mu$ m. Figs 2, 3, 5–10 to same scale.

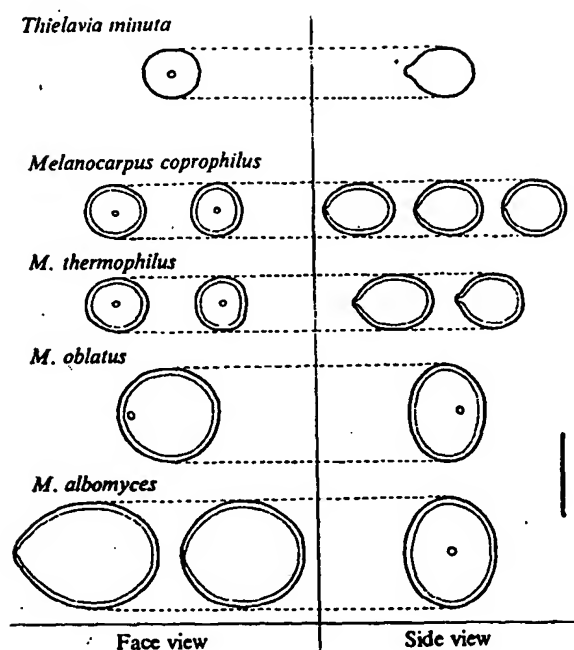


Fig. 11. Comparative morphology of ascospores in *Melanocarpus* (Bar = 10 µm).

between the Iraqi fungus and *T. minuta*, Abdullah & Al-Bader proposed a new variety. We had the opportunity of comparing the holotype of *T. minuta* with the Iraqi fungus and we realized that they are quite different and both of unclear taxonomic position. The differences between them are basically the morphology of the ascospores, which are variable in shape but more or less globose, thick-walled and opaque in the Iraqi fungus and typically ovoid, thin-walled, markedly pointed at one end and brown in *T. minuta*; ascomata are bigger and with a peridium of *textura epidermoidea* in the first one and of *textura angularis* in the second. In addition var. *thermophila* is thermophilic and *T. minuta* is mesophilic. According to these characteristics the Iraqi fungus is best accommodated in *Melanocarpus* (von Arx *et al.*, 1988).

*T. minuta*, on the other hand, is also a controversial fungus as it does not match the main features of *Thielavia* (von Arx *et al.*, 1988). The ascospores of *Thielavia* are generally fusiform or ellipsoidal, and in *T. minuta* they are typically ovoid with a very pointed end. In addition the peridium in *Thielavia* is always a *textura epidermoidea*. *T. minuta* displays certain affinities with *Chaetomium indicum* Corda. The existence of these two interesting isolates suggests that the delimitation between the Thielaviaceae (von Arx *et al.*, 1991), the Chaetomiaceae and the Ceratostomataceae (Eriksson & Hawksworth, 1991) is not well-established. Therefore further studies, possibly based on molecular techniques, are needed for a more natural delimitation of these taxa.

#### Key to *Melanocarpus* spp.

- |   |                        |
|---|------------------------|
| 1. Ascospores usually shorter than 10 µm . . . . .  | 2                      |
| 1. Ascospores usually longer than 10 µm . . . . .   | 3                      |
| 2. Ascomata glabrous; ascospores 7–8 × 6–6.5 µm; mesophilic . . . . .                     | <i>M. coprophilus</i>  |
| 2. Ascomata covered with short setae; ascospores 7.5–9 × 6–7.5 µm; thermophilic . . . . . | <i>M. thermophilus</i> |
| 3. Ascospores 10–12 × 8–9 µm; mesophilic . . . . .  | <i>M. oblatum</i>      |
| 3. Ascospores 13–16 × 11–14 × 9–11 µm; thermophilic . . . . .                             | <i>M. albomyces</i>    |

*Melanocarpus albomyces* (Cooney & Emerson) Arx, *Stud. Mycol.* 8: 16 (1975) (Figs 8, 11)

≡ *Myriococcum albomyces* Cooney & Emerson, *Thermophilic Fungi*, p. 60 (1964)

≡ *Thielavia albomyces* (Cooney & Emerson) Malloch & Cain, *Can. J. Bot.* 50: 65 (1972).

Ascomata superficial, smooth, black, 160–700 µm diam. Peridium dark brown, *textura angularis*. Asci 8-spored, obovate, clavate or saccate, 34–45 × 16–25 µm. Ascospores oblate, circular to broadly ovate in face view and elliptical in side view, 13–16 × 11–14 × 9–11 µm, dark brown, with a distinct germ pore. Conidia cylindrical or fusiform or clavate with a truncate base, hyaline, usually catenate.

*Material examined*: CBS 177.67 (strain ex type), CBS 747.70.

A full description with SEM illustrations is in von Arx *et al.* (1988).

*Melanocarpus coprophilus* Guarro & Valldos., sp. nov. (Figs 9, 11)

Ascomata superficialia, sphaerica, glabra, brunneo-nigra, 250–300 µm diam; pariete e cellulis angularibus applanatis, fuscotunicatis composita; asci saccati, 8-spore, tenui-tunicati, 44–88 × 10–12 µm; ascosporeae aseptatae, globosae usque late ellipsoidales interdum complanatae unica lateralibus visae, 7–8 × 6–6.5 µm, brunneo-nigrae, poro germinationis distincti praeditae. Anamorphosis incognita.

*Holotypus*: FMR 2601, cultura exsiccata.

Ascomata superficial, globose, glabrous, brown to black, 250–300 µm diam. Peridium dark brown, *textura angularis*. Asci 8-spored, saccate, 44–48 × 10–12 µm, evanescent. Ascospores unicellular, globose to broadly ellipsoidal sometimes with a flattened side, 7–8 × 6–6.5 µm, brown to black, with a distinct germ pore. Anamorph not known.

*Material examined*: FMR 2601 (holotype) from rabbit dung, San Martín de Rubiales, Burgos, Spain, 18 Aug. 1986, leg. M. Hernández.

A more complete description is in Valldosera & Guarro (1992), where the species was published as *Melanocarpus* sp.

*Melanocarpus oblatum* Guarro & Aa, In von Arx *et al.*, *Persoonia* 13: 270 (1987) (Figs 10, 11)

Ascomata immersed or semi-immersed, covered with yellow hyphae, dark brown, 160–260 µm diam. Peridium dark brown, *textura angularis*. Asci 8-spored, cylindrical or obovate-saccate, 50–70 × 10–15 µm. Ascospores oblate, circular in face view, elliptical in side view, 10–12 × 8–9 µm, dark brown, with a distinct, lateral (excentric) germ pore. Arthroconidia cylindrical or barrel-shaped occasionally formed.

*Material examined:* CBS 775.85 (strain ex type).

This species is represented by a single strain from Upper Volta. It was described and illustrated by von Arx *et al.* (1987).

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